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IS : 5951 - 1985

REAFFIRMED

Indian Standard

**METHOD FOR
DETERMINATION OF COLOUR FASTNESS OF
TEXTILE MATERIALS TO WEATHERING
BY OUTDOOR EXPOSURE**

(First Revision)

UDC 677·016·474 : 535·686·4



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**INDIAN STANDARDS INSTITUTION
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METHOD FOR DETERMINATION OF COLOUR FASTNESS OF TEXTILE MATERIALS TO WEATHERING BY OUTDOOR EXPOSURE

(*First Revision*)

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Indian Standard
METHOD FOR
DETERMINATION OF COLOUR FASTNESS OF
TEXTILE MATERIALS TO WEATHERING
BY OUTDOOR EXPOSURE
(First Revision)

0. F O R E W O R D

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 15 October 1985, after the draft finalized by the Chemical Methods of Test Sectional Committee had been approved by the Textile Division Council.

0.2 This standard was first published in 1970 and has been revised to include changes carried out in similar colour fastness standards regarding sampling, specimen size, composition of soap, apparatus and to align it with ISO 105 B 03-1981 'Textiles — Test for colour fastness to weathering: Outdoor exposure'; issued by the International Organization for Standardization (ISO).

0.3 Colour fastness of textile materials to weathering is of considerable importance to consumers, especially in case of defence textile stores like camouflage tents and tarpaulins which are dyed and printed so as to mix with the surrounding colours of nature.

0.4 Two methods for mounting and testing of specimens for colour fastness to weathering by outdoor exposure have been prescribed in this standard. Method 1 is considered preferable and should be used in cases of dispute but it requires one set of standard patterns for each test specimen and is, therefore, impracticable when a large number of test specimens have to be tested concurrently. Method 2 enables a large number of test specimens of differing light fastness ratings to be rated against a single set of standard patterns. This method is used when a large number of test specimens have to be tested concurrently.

1. SCOPE

1.1 This standard prescribes two methods for the determination of colour fastness of textile materials of all kinds and in all forms except loose fibres to the action of weathering by outdoor exposure.

2. PRINCIPLE

2.1 Specimens of textiles are exposed under specified conditions in the open air without any protection from weathering. At the same time and in the same place, eight standard patterns of blue wool cloth are exposed to daylight but are protected from rain, snow, etc, by a sheet of window glass. The fastness is assessed by comparing the change in colour of the specimen with that of the standard patterns.

2.1.1 The wide variations in conditions under which outdoor exposures are usually carried out, make it desirable to make replicate exposures starting at different times of the year. The most reliable indication of weathering fastness is obtained by taking the mean of several exposures.

3. SAMPLING

3.1 Lot — The quantity of same kind of yarn or fabric dyed or printed under essentially similar conditions shall constitute a lot.

3.2 Samples shall be drawn from the lot so as to be representative of the lot. Samples drawn as prescribed in material specification for the coloured textile materials, or as agreed to between the buyer and the seller to evaluate the colour fastness of the material in the lot shall be held to be representative of the lot.

4. PREPARATION OF TEST SPECIMENS AND STANDARD PATTERNS

4.1 If the material to be tested is a fabric, draw two specimens from each lot, each measuring at least 10 cm × 4 cm and sew along each side on to a piece of scoured, undyed cloth made of hydrophobic fibre, such as polyester or acrylic.

4.1.1 If the material to be tested is yarn, knit or weave it into a fabric and then treat it as in 4.1. If facilities do not exist for knitting or weaving the yarn into fabric, the yarn may be wound over an inert material covered with a piece of scoured, undyed cloth made of hydrophobic fibre, such as polyester or acrylic. Draw two such specimens from each lot.

NOTE — Loose fibres are not suitable for weathering tests.

4.2 Standard Patterns — Mount strips of light fastness standard patterns (*see* 5) of 10 cm × 4 cm size on cardboard and cover the middle one-third (*see* Fig. 1 and 2) with an opaque cardboard.

NOTE 1 — To facilitate handling, the test specimens and strips of the standard patterns of similar size may be mounted on a card in some such arrangement as indicated in Fig. 1 or Fig. 2. Each exposed and unexposed area shall not be less than 1 cm × 1 cm.

NOTE 2 — The test specimens and the standard patterns should be of equal size and shape in order to avoid errors in assessment due to over rating the visual contrast between exposed and unexposed parts on the larger specimens as against the narrower standard patterns.

NOTE 3 — When testing carpets, the standard patterns shall be arranged in such a way that they are at the same distance from the light source as the surface of the carpet specimens. This can be achieved by underlaid cardboard.

5. STANDARD PATTERNS

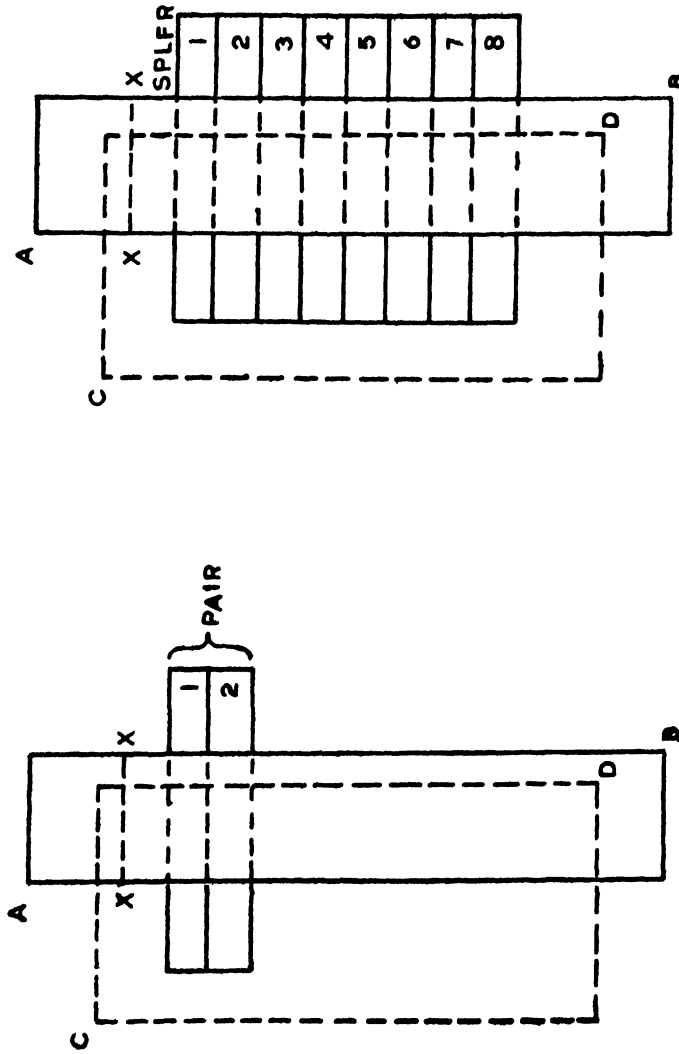
5.1 Standard patterns of blue wool cloth with light fastness ranging from rating No. 1 (very low light fastness) to rating No. 8 (very high light fastness) and dyed with the dyes as prescribed below shall be used for this test.

<i>Fastness Rating No.</i>	<i>Dye [Colour Index (CI) Designation (see Note 1)]</i>
1	CI Acid Blue 104
2	CI Acid Blue 109
3	CI Acid Blue 83
4	CI Acid Blue 121
5	CI Acid Blue 47
6	CI Acid Blue 23
7	CI Solubilized Vat Blue 5 (<i>see</i> Note 2)
8	CI Solubilized Vat Blue 8 (<i>see</i> Note 2)

NOTE 1 — The Colour Index (Third Edition) published by the Society of Dyers and Colourists, P.O. Box 244, Parkins House, 83 Grattan Road, Bradford BD1 2 JB, West Yorks, UK.

NOTE 2 — The patterns dyed with these dyes should be decatized after dyeing.

NOTE 3 — Sets of standard patterns of light fastness rating No. 1 to 8 may be obtained from the Indian Standards Institution or the British Standards Institution. They are specially dyed to match the master set of standard patterns in colour and in fading behaviour. It has been found that when repeated dyeings for the dyed standard patterns are made, the amount of dye required to match a previous lot is often different from the originally used. The dyeing strengths would, therefore, be misleading and they are intentionally omitted from this list.



1A Exposure of Test Specimens

1B Exposure of Standard Patterns

SPLFR — Standard patterns for light fastness rating
AB — Opaque cover — may be hinged at XX so that it may be lifted and returned to the same place over the standard patterns
CD — Another opaque cover

FIG. 1 MOUNTING OF TEST SPECIMENS AND STANDARD PATTERNS FOR METHOD 1

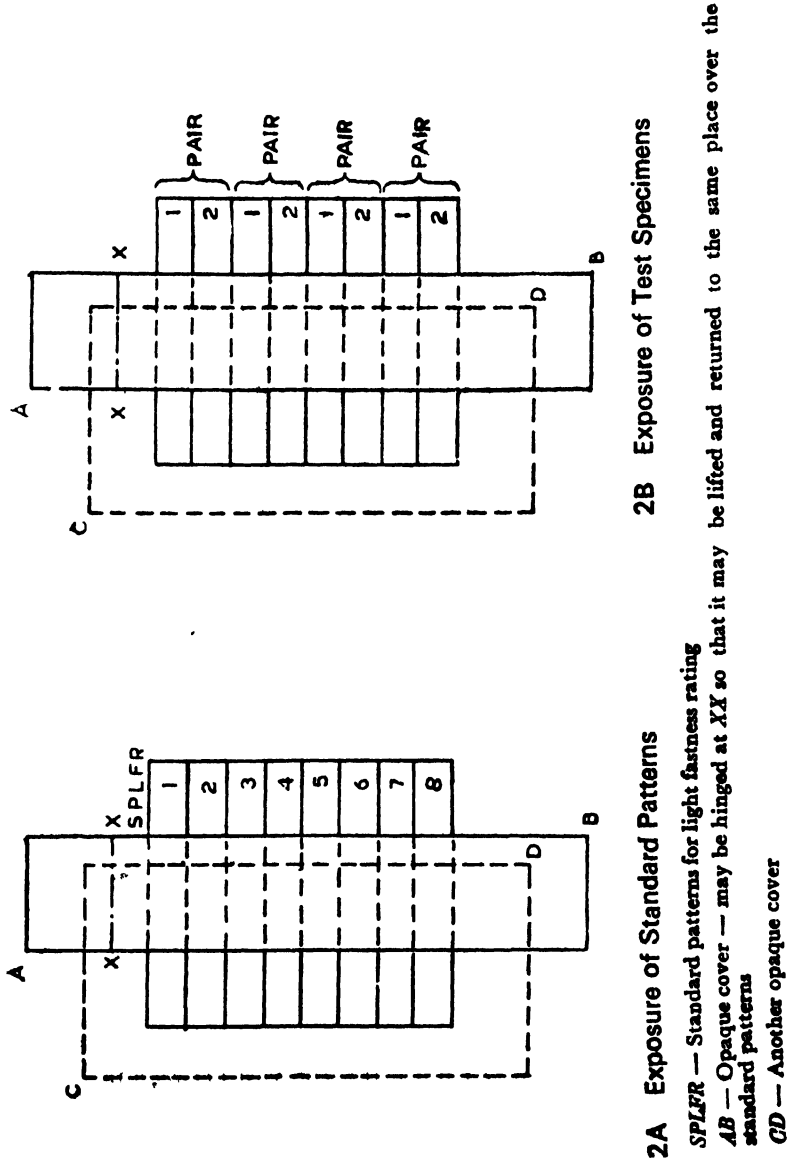


FIG. 2 MOUNTING OF STANDARD PATTERNS AND TEST SPECIMENS FOR METHOD 2

6. APPARATUS

6.1 Exposure Rack for Specimens — The rack should be facing due south in the Northern Hemisphere (or due north in the Southern Hemisphere) and sloping at an angle from the horizontal approximately equal to the latitude of the place where the exposure is made. It should be located in open at such a place that the shadow of surrounding objects do not fall on the exposed textiles, and constructed such that the specimens or the cloths on which the specimens are sewn or wound are firmly held. There should be free circulation of air behind the mounted specimens.

NOTE — The test may be carried out preferably in a non-residential and non-industrial area free from dust and automobile exhaust fumes.

6.2 Exposure Rack for Standard Patterns — The rack should be oriented similarly as given in 6.1 and covered with a glass to protect the standard patterns from weathering, the glass being not less than 5 cm from the standard patterns and shall be provided with adequate ventilation. The glass shall have a transmission of at least 90 percent between 380 and 750 nm falling to zero percent between 310 and 320 nm.

6.3 Opaque Cardboard or Thin Opaque Material — For example, a thin sheet of aluminium or cardboard covered with aluminium foil or, in the case of pile fabrics, a cover that avoids surface compression. It is used for covering the standard patterns.

6.4 Geometric Grey Scale — for evaluating the change in colour (*see* IS : 768-1982*).

7. PROCEDURE COMMON TO METHOD 1 AND 2

7.1 Firmly attach the specimens or the cloth to which the specimens have been sewn or wound, to the exposure rack (*see* 6.1). Place the mounted and partially covered standard patterns in the glass covered rack (*see* 6.2). Expose the specimens and the standard patterns simultaneously 24 h per day for such times as are necessary to evaluate the weathering fastness using either Method 1 or Method 2 (*see* 7.2 and 7.3).

7.2 Method 1

7.2.1 Expose the specimens and the standard patterns (*see* Fig. 1) under the conditions as given in 7.1 until the contrast between the exposed specimens and a portion of the original fabric is equal to Grade 3 on the grey scale. Remove one of the specimens and cover the left hand one-third of the standard patterns with an additional opaque cover.

*Method for evaluating change in colour (*first revision*).

7.2.2 Continue the exposure until the contrast between the remaining specimen and a portion of the original fabric is equal to Grade 2 on the grey scale. If Standard Pattern 7 fades to a contrast equal to Grade 4 on the grey scale before the contrast between the specimen and a portion of the original fabric is equal to Grade 2 on the grey scale, the exposure may be concluded at this stage and the remaining specimen and the standard patterns removed.

7.2.3 Wash both specimens as well as a portion of the original fabric and prepare them for assessment to weathering fastness as given in 7.4 and 7.5 respectively.

7.3 Method 2

7.3.1 Expose the specimens and the standard patterns (*see* Fig. 2) under the conditions given in 7.1 until the contrast between the exposed and the unexposed portion of Standard Pattern 6 is equal to Grade 4 on the grey scale. At this stage, remove one specimen from each pair and cover the left hand one-third of the standard patterns with an additional opaque cover.

7.3.2 Continue the exposure until the contrast between the fully exposed and unexposed portion of Standard Pattern 7 is equal to Grade 4 on the grey scale. Remove the remaining specimens and the standard patterns.

7.3.3 Wash the exposed specimens and a portion of the original fabric from each specimen and prepare them for assessment to weathering fastness as given in 7.4 and 7.5 respectively.

7.4 Washing of Test Specimens

7.4.1 Wash the exposed specimens and a portion of the original fabric measuring at least 10 cm × 4 cm (in the absence of undyed cloth) under the conditions specified in IS : 687-1979* (*see* Note).

NOTE — Extracts of the washing procedure as given in IS : 687-1979* are provided in Appendix A.

7.4.2 Trim and mount the washed specimens one on each side of the washed original fabric which has been trimmed to the same size and shape as the specimens. The specimens exposed for shorter length of time should be mounted on the left.

7.5 Assessment of Fastness

7.5.1 First Assessment — Compare the magnitude of the contrast between the specimen exposed for the shorter time and the original fabric in terms of the contrasts produced on the standard patterns exposed for the same

*Method for determination of colour fastness of textile materials to washing: Test 1 (*second revision*).

period. The assessment is the number of the standard pattern showing the contrast closest to that of the specimen. If the specimen shows a change in colour approximately half way between the two standard patterns, an appropriate half rating, for example, 5-6 shall be given.

7.5.2 Second Assessment — Compare the magnitude of the contrast between the specimen exposed for the longer time and the original fabric in terms of the contrast produced in the standard patterns exposed for the same period. The assessment is the number of the standard pattern showing the contrast closest to that of the specimen. If the specimen shows a change in colour approximately half way between two standard patterns, an appropriate half rating, for example, 3-4 shall be given.

NOTE 1 — The term 'change in colour' includes not only true fading, that is destructions of dyes, but also changes in the hue, depth, brightness or any combination of these characteristics of colour. If the difference in colour is a change of hue or brightness, this may be indicated by adding abbreviations as follows to the numerical fastness rating:

Bl = bluer
R = redder

Y = yellower
G = greener

D = duller
Br = brighter

If the change in hue is accompanied by change in depth, this may also be indicated as follows:

W = weaker

Str = Stronger

NOTE 2 — Phototropic test specimens should be allowed to condition in dark at room temperature for 24 hours before evaluating the change in colour.

7.5.3 If specimens larger than the standard patterns are exposed, a mask of a neutral grey colour approximately midway between Grade 1 and Grade 2 of the grey scale for assessing change in colour (approximately Munsell N5) should be used in the assessment which should cover the surplus area of the specimen and leaving an area equal to that of the standard patterns open for comparative evaluation.

8. REPORT

8.1 The report shall include the following:

- a) The numerical ratings for weathering fastness by outdoor exposure (if the two assessments carried out as in 7.5.1 and 7.5.2 are different, report only the lower one); and
- b) Place of exposure and the time of the year.

APPENDIX A

(Clause 7.4.1)

DETAILS OF METHOD FOR WASHING OF TEST SPECIMENS**A-1. APPARATUS**

A-1.1 A suitable mechanical washing device conforming to the following requirements shall be used:

- a) A water-bath containing a rotor with which containers (of glass or of stainless steel) are rotated at a speed of 40 ± 2 rev/min.
- b) Means for thermostatically controlling the temperature of water-bath so as to maintain the temperature of test solution in the containers at $40 \pm 2^\circ\text{C}$.

NOTE — The wash-wheel sponsored by the Society of Dyers and Colourists or the Launderometer sponsored by the American Association of Textile Chemists and Colorists or other mechanical apparatus giving identical results may be used for this test.

A-2. SOAP SOLUTION

A-2.1 It shall contain 5 g of soap per litre. The soap shall contain not more than 5 percent moisture and shall comply with the following requirements based on dry weight:

Free alkali calculated as Na_2CO_3 (m/m)	0.3 percent, <i>Max</i>
Free alkali calculated as NaOH (m/m)	0.1 percent, <i>Max</i>
Comained fatty acids calculated as sodium salt (m/m)	85 percent, <i>Min</i>
Titre of mixed fatty acids prepared from the soap	39°C , <i>Max</i>
Iodine value of fatty acids	50, <i>Max</i>
The soap shall be free from flourescent brightening agents.	

NOTE — Information regarding availability of soap of this composition can be had from ISI.

A-3. PROCEDURE

A-3.1 Place one of the specimens in a container and add to it the necessary amount of soap solution previously heated to $40 \pm 2^\circ\text{C}$ to give a liquor to material ratio of 50 : 1. Treat the specimen for 30 minutes at $40 \pm 2^\circ\text{C}$ in the mechanical washing device. Remove the specimen, rinse it twice in cold water and then in cold running tap water for 10 minutes. Squeeze it and dry in air at a temperature not exceeding 60°C .

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(*First Revision*)

(*Clause 7.5.2, Notes*) — Insert the following ' *NOTE 3* ' after ' *NOTE 2* ':

'*NOTE 3* — In cases of doubt in the colour fastness ratings as assessed by an observer, the assessment should be done by at least three observers and the overall average rating should be reported.'

(TDC 5)

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